FPL Energy
Seabrook Station

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Docket No. 50-443
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United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

Reference: "Seabrook Station, Unit No. 1 – Request for Additional Information Regarding Bulletin 2003-01 (TAC NO. MB9612)," dated September 10, 2004

Seabrook Station
Response to Request for Additional Information Regarding Bulletin 2003-01

Enclosed is the FPL Energy Seabrook, LLC response to the above referenced Request for Additional Information regarding Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors."

Should you have any questions regarding this response, please contact Mr. Robert E. White, Engineering Manager, at (603) 773-7854.

Very truly yours,

FPL Energy Seabrook, LLC

for Mark Warner

Mark E. Warner
Site Vice President

cc: S. J. Collins, NRC Region I Administrator
S. P. Wall, NRC Project Manager, Project Directorate I-2
G.T. Dentel, NRC Senior Resident Inspector

A103

OATH AND AFFIRMATION

I, Michael W. Kiley, Operations Manager of Seabrook Station, am authorized to execute this oath on behalf of FPL Energy Seabrook, LLC and, to the best of my knowledge and belief, the facts set forth in this letter are true.

Sworn and Subscribed
before me this

28 day of October, 2004

Michael O'Keefe
Notary Public

Michael W. Kiley
Michael W. Kiley
Operations Manager

MICHAEL D. O'KEEFE
MY COMMISSION EXPIRES FEB. 5, 2008
NOTARY PUBLIC
NEW HAMPSHIRE

FPL Energy Seabrook Station
NRC Bulletin 2003-01
Response to Requests for Additional Information

REQUESTED ADDITIONAL INFORMATION

This response addresses Request for Additional Information regarding NRC Bulletin 2003-01. The Seabrook Station response to this bulletin was provided to the NRC by letter NYN-03071 (Common Letter L-2003-201), "NRC Bulletin 2003-01, Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized Water Reactors," dated August 8, 2003. During the course of its review of this response, the Nuclear Regulatory Commission staff determined that additional information was needed to complete its review. The requests are delineated in the enclosure to a letter from the NRC, "Seabrook Station, Unit 1 – Request for Additional Information Regarding Bulletin 2003-01 (TAC NO. MB9612)," dated September 10, 2004.

The following is the Seabrook Station response to the three (3) items of requested information:

Request 1. In response to Bulletin 2003-01, the licensee listed a number of existing indications that could indicate the onset of sump blockage, existing operator guidance documents relating to monitoring for sump blockage (e.g. pump motor current, pump flow rate, and pump discharge pressure), and enhanced training for operators and engineering support personnel on the issue of containment sump clogging. However, the licensee's response does not completely discuss the operator training to be implemented; in that, they do not discuss the existing response actions the operators are instructed to take in the event of sump clogging and loss of emergency core cooling systems (ECCS) recirculation capability. Provide a detailed description of how the current emergency operating procedures address sump clogging and a loss of ECCS recirculation capability.

Response 1. The response below is a detailed discussion of existing operator actions, included in the revised EOPs, to sump clogging and loss of ECCS recirculation capability. The details below are presented in a scenario format and include a synopsis of the guidelines now included in the emergency response procedures from the onset of the LOCA condition through the responses to sump clogging and loss of ECCS recirculation capability. This discussion expands on the information provided in Sections 1, 2, and 3 of Attachment 3 to L-2003-201, "NRC Bulletin 2003-01, Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized Water Reactors," dated August 8, 2003. The emergency response procedures being discussed include:

- E-1, "Loss of Reactor or Secondary Coolant"
- ES-1.1, "SI Termination"

- ES-1.2, "Post LOCA Cooldown and Depressurization"
- ES-1.3, "Transfer to Cold Leg Recirculation"
- ECA-1.1, "Loss of Emergency Coolant Recirculation."

Injection Phase of a LOCA

In NRC Bulletin 2003-01, the NRC provides an example of a procedural modification that would delay the switchover to containment sump recirculation. This procedural change would involve shutting down redundant pumps that are not necessary to provide required flows for core heat removal and containment building cooling / depressurization / iodine removal. The scenario-based discussion that follows addresses current operator actions in this regard, considering a range of LOCA sizes.

Small Break LOCA:
Shortly following a small break LOCA, the operators would enter into procedure E-1, "Loss of Reactor or Secondary Coolant." Step 6 of E-1 is to check if ECCS flow should be reduced. The conditions in this step would be met with a sufficiently small LOCA, and the operator is directed to go to ES-1.1, "SI Termination". Step 2 of ES-1.1 has the operator stop all but one charging pump. With an actual LOCA, albeit small, this would likely result in a declining RCS pressure. Step 3 checks for such reduction in RCS pressure, which then directs the operator to go to ES-1.2, "Post LOCA Cooldown and Depressurization." Based on this scenario, Step 22 restarts ECCS pumps as necessary to provide adequate pressurizer level and subcooling. However, even if all ECCS pumps are operating, the pressure of the RCS during sufficiently small break LOCAs precludes the intermediate safety injection pumps and RHR pumps from injecting into the RCS, thereby not contributing to draw down of RWST inventory. ES-1.2 then directs actions to cooldown and depressurize the RCS to reduce the break flow, thereby reducing the injection flow necessary to maintain RCS subcooling and inventory. During this cooldown, the operating ECCS pumps are sequentially stopped to reduce injection flow, based on pre-established criteria that maintain core cooling, resulting in less outflow from the RWST. For small LOCAs, it is likely that the RCS would be cooled down and depressurized to cold shutdown conditions before the RWST is drained to the switchover level. Therefore cold leg recirculation is not required to be established, and sump blockage is not an issue.

Medium Break LOCA:
Shortly following a medium break LOCA, the operators would enter into procedure E-1, "Loss of Reactor or Secondary Coolant." Step 6 of E-1 is to check if ECCS flow should be reduced. The conditions in this step would however not be met. Step 7 of E-1 is to check if containment spray should be stopped. If containment pressure is less than 4 psig, containment spray pumps are stopped. Step 8 checks if RHR pumps should be stopped. RHR pumps are stopped if RCS

pressure is greater than 260 psig and is stable or increasing. Based on Figure 15.6-41 of the UFSAR for a 6-inch break, the RCS pressure would approximately meet this criterion, assuming a single train of ECCS injection. Note that the basis for the criteria is the capability of the RHR pump to inject into the RCS. Therefore, even if no action is taken by the operators to stop the pumps, there would be no RHR flow injected into the RCS, and therefore volume drawn from the RWST. This would be the case for LOCAs caused by break sizes of approximately 6 inches or less for single train ECCS operation. Therefore, if both ECCS trains are operating, breaks somewhat larger than 6 inches would result in no RHR being injected. Step 11 of E-1 evaluates plant status, including a substep to evaluate equipment operation per Attachment A. Attachment A directs the operator to evaluate pump performance using parameters from the control room: bearing temperature, flow, suction pressure, discharge pressure, and amps. Step 12 checks if RCS cooldown and depressurization is required. If RCS pressure is greater than 260 psig, with no RHR flow indicated, the operator is directed to go to ES-1.2, "Post LOCA Cooldown and Depressurization." Based on this medium LOCA scenario, the procedure directs actions to cooldown and depressurize the RCS to reduce the break flow, thereby reducing the injection flow necessary to maintain RCS subcooling and inventory. During this cooldown, the remaining operating ECCS pumps are sequentially stopped to reduce injection flow, based on pre-established criteria that maintain core cooling, resulting in less outflow from the RWST. For medium LOCAs of the magnitude considered above, it is possible that cold leg recirculation would not be required to be established, and sump blockage would not an issue.

Large Break LOCA:
Shortly following a larger break LOCA, the operators would enter into procedure E-1, "Loss of Reactor or Secondary Coolant." Step 6 of E-1 is to check if ECCS flow should be reduced. The conditions in this step would however not be met. Step 7 of E-1 is to check if containment spray should be stopped. If containment pressure is less than 4 psig, containment spray pumps are stopped. This condition would however not likely be met. Step 8 checks if RHR pumps should be stopped. RHR pumps are stopped if RCS pressure is greater than 260 psig and is stable or increasing. This condition would however not likely be met. Step 11 of E-1 evaluates plant status, including a substep to evaluate equipment operation per Attachment A. Attachment A directs the operator to evaluate pump performance using parameters from the control room: bearing temperature, flow, suction pressure, discharge pressure, and amps. Step 12 checks if RCS cooldown and depressurization is required. If RCS pressure is greater than 260 psig, with no RHR flow indicated, the operator is directed to go to ES-1.2, "Post LOCA Cooldown and Depressurization." Based on this larger break LOCA scenario, this condition would not be met.

For large break LOCAs, steps of pre-emptive operator actions to stop pumps or throttle flow solely for the purpose of delaying switchover to containment sump recirculation have not been implemented. As discussed in Section 2 of Attachment 3 to L-2003-201, "NRC Bulletin 2003-01, Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized Water Reactors," such changes were not considered until a WOG evaluation of the impact of the changes was completed on a generic basis. The WOG has since completed this evaluation, as detailed in WCAP-16204, Rev. 1, "Evaluation of Potential ERG and EPG Changes to Address NRC Bulletin 2003-01 Recommendations (PA-SEE-0085)," dated March 2004. As discussed in response to Request 2, below, review of the candidate operator actions by WOG to stop an operating ECCS or CBS pump at Seabrook Station during the injection phase following a LOCA, revealed that such actions are not feasible and/or advantageous for the Seabrook Station design.

Transfer to Cold Leg Recirculation Phase

For larger LOCAs, it is likely that the RWST would be emptied to an unusable volume (due to tank vortexing) such that the suction of the ECCS and CBS pumps would have to be transferred to the containment recirculation sump. Step 13 of procedure E-1, "Loss of Reactor or Secondary Coolant" checks if transfer to cold leg recirculation is required. If either the ECCS automatic switchover to the containment sump has actuated or there is less than 115,000 gallons in the RWST, the operator is directed to go to procedure ES-1.3, "Transfer to Cold Leg Recirculation." This procedure first verifies that containment sump recirulation supply valves have automatically opened and then directs the operators to close the RWST suction valves. Step 4.c has the operators close the recirculation mini-flow valves for the intermediate head safety injection (SI) pumps. This results in a small reduction in SI pump flow rate. One of the RHR discharge to cold leg isolation valves is then closed in Step 4.e. This step reduces total RHR flow and increases NPSH margin for the ECCS pumps. This is a Seabrook Station-unique step that had been developed in 1986, based on a Westinghouse analysis (NAH-3092, Rev. 1). That analysis demonstrated that, with a single failure of an RHR pump or ECCS train, there was a shortfall in NPSH for the remaining operating RHR pump and the centrifugal charging (high head injection) pumps. The resulting decrease in total ECCS flow rate also provides a benefit of additional margin for the sump screen clogging concern. Step 5 of ES-1.3 isolates the suction valves for the SI and centrifugal charging pumps from the RWST.

Procedure continuous action step 10 of ES-1.3 monitors the performance of RHR, centrifugal charging, SI and CBS pumps performance. This primary purpose of this step is the detection and mitigation of potential sump clogging. This step directs the operator to evaluate pump performance using parameters, including flow, discharge pressure, and amps. If pump parameters indicate RHR pump suction is lost, then the pumps in the affected train are stopped. Since the SI and centrifugal charging pumps take suction from the RHR pumps, the associated SI and charging pumps would be stopped prior to stopping the affected RHR pump. If pump parameters indicate single pump suction (CBS, centrifugal charging pump, or SI pump) is lost, the individual affected pump(s) are stopped. If both trains of emergency recirculation are lost, the operator is directed to go to procedure ECA-1.1, "Loss of Emergency Coolant Recirculation." Attachment A is referred to as a continuous step reference for the above monitoring pump parameters, including flow, discharge pressure, amps, bearing temperatures, and suction pressure, while using other procedures.

Based on the Seabrook Station design attributes regarding pump NPSH, should a sump screen clogging event occur, the following is the most likely sequence of events. The first pumps to show indications of a loss of suction would be the containment spray (CBS) pumps. Therefore, it is likely that the CBS pumps would be stopped. This action would provide additional NPSH margin for the RHR pumps, resulting in a delay or elimination of the need to terminate ECCS recirculation. This is based on the fact that there is more margin on the NPSH for the RHR pumps than for the CBS pumps. As indicated in the Seabrook Station response (NYN-98001) to NRC Generic Letter 97-04, "Assurance of Sufficient Net Positive Suction Head for Emergency Core Cooling and Containment Heat Removal Pumps," there is a 2.5 feet margin for the RHR pumps, as opposed to about a 0.5 feet margin on the CBS pumps. In fact, with 2 RHR pumps running, since the two RHR trains are cross-connected, the NPSH margin is greater than the analyzed NPSH available, which is based on a single failure of an RHR pump. It should be noted that the NPSH margin for the SI and centrifugal charging pumps is much higher than the other pumps and, for the recirculation phase, much higher than that listed in NYN-98001. The reason for this is that, for this mode, the suction to these pumps is provided by RHR pump discharge pressure, which is greater than the pressure provided by the RWST for which the limiting available NPSH applies.

<u>Response to Sump Clogging and Loss of ECCS Recirculation Capability</u>

As mentioned above, during the recirculation phase, if both trains of emergency recirculation are lost for sump clogging or other reason, the operator is directed to go to procedure ECA-1.1, "Loss of Emergency Coolant Recirculation." Step 1 checks for the recirculation lineup. For larger break LOCAs where potential sump clogging is an issue, the conditions of this step would be satisfied.

Step 2 of ECA-1.1 is therefore performed, which aligns the centrifugal charging pumps from the recirculation sump back to the RWST. As discussed in Section 3 of Attachment 3 to L-2003-201, "NRC Bulletin 2003-01, Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized Water Reactors," this realignment effectively provides an additional source of borated water from the unused capacity remaining in the RWST. The ECCS pump switchover level from the RWST to the containment recirculation sumps is based on potential vortexing in the RWST with operation of all of the ECCS pumps through the spray additive tank mixing chamber. The charging pumps take suction from the RWST through separate lines, allowing them to be used for injection of additonal unused RWST capacity. This lineup effectively provides an additional source of water in the RWST (approximately 30,000 to 70,000 gallons, depending on the time it takes the operators to complete the RWST switchover).

Step 3 of ECA-1.1 is then performed to establish minimum charging pump flow to remove decay heat. The charging pump miniflow valves are closed and the charging pump supply valves to the RCS cold legs are throttled, as necessary, to establish charging pump flow to match decay heat flow requirements.

Step 4 of ECA-1.1 commences RWST makeup using the chemical and volume control system (CVCS) blended makeup. Step 5 (and later step 29) verifies adequate RCS makeup flow (via the charging pumps) by checking Reactor Vessel Level Indication System (RVLIS) and core exit thermocouples. Step 8 tries to restore at least one RHR pump to an operable condition. The operators may restart an RHR pump, recognizing that less ECCS pumps are taking suction from the sump thereby resulting in more available NPSH. Step 14 again addresses the addition of RWST makeup via CVCS blended makeup per Attachment A. RCS cooldown to cold shutdown is initiated in step 16, by using steam dump valves. Step 31 checks if RHR should be placed in service. The pressure and temperature conditions of the RCS, for a large break LOCA, would be satisfied. The TSC is consulted. The guidelines for TSC consideration include aligning the RHR pumps to the hot leg (option if the LOCA has not emptied the loop), the containment sump, or the RWST (most likely not enough inventory). Considering that less ECCS pumps are taking suction from the sump, maintaining RHR alignment to the sump and restarting an RHR pump may be the recommended action by the TSC. Finally, if the RWST reaches a level where the charging pumps can no longer take suction from the RWST, step 39 of ECA-1.1 (with reference to Attachment D of the procedure) aligns the volume control tank (VCT) for makeup via the CVCS blended makeup system and for supply to the charging pumps to the RCS.

Request 2. The Westinghouse Owners Group (WOG) has developed operational guidance in response to Bulletin 2003-01 for Westinghouse and Combustion Engineering type pressurized water reactors. For Seabrook, the licensee's response stated that they will monitor the WOG activities and will consider implementation of any issued guidance. Provide a discussion of the WOG-recommended compensatory measures that have been or will be implemented for the plants. Include a discussion of the evaluations or analyses performed to determine that these compensatory measures are acceptable for Seabrook, and provide technical justification for those WOG compensatory measures not being implemented. Also include a detailed discussion of the procedures being modified, the operator training being implemented, and the schedule for implementing these compensatory measures.

Response 2. The WOG has completed an evaluation of operational guidance to address Bulletin 2003-01, as detailed in WCAP-16204, Rev. 1, "Evaluation of Potential ERG and EPG Changes to Address NRC Bulletin 2003-01 Recommendations (PA-SEE-0085)," dated March 2004. Each of the candidate operator actions (COAs) for compensatory measures included in this report have been evaluated for applicability and considered for implementation at Seabrook Station. Below are the results of the evaluation, including a discussion of the interim compensatory measures being implemented and technical justification for those not being implemented. It is noted that actions for emergency procedures and associated operator training in this regard had been previously considered by Seabrook Station and were implemented, as of September 2003.

A1a-CE – Candidate Operator Action 1A – Combustion Engineering Plants Operator Action to Secure One Spray Pump

This COA is applicable to Combustion Engineering Plants only.

Seabrook Station Evaluation

Seabrook Station is a Westinghouse plant. Therefore, this COA is not applicable to Seabrook Station.

A1a-W – Candidate Operator Action 1A – Westinghouse Plants Operator Action to Secure One Spray Pump

The following describes the steps that would be necessary to accomplish this action.

1. It should be verified that both containment spray pumps are operating. If this can not be confirmed no action should be taken to stop a containment spray pump.

2. Prior to stopping a containment spray pump, it should be confirmed that the spray pumps have completed their safety function by confirming the following:

    a. Containment pressure is less than [Containment Design Pressure] and NOT increasing.

    b. Containment temperature is less than [EQ requirement] °F and NOT increasing.

3. Prior to stopping a containment spray pump, adequate heat removal should exist to allow the operator time to start the idle spray pump if the running pump fails. Verify that two or more containment fan coolers are

operating.

4. Plants that credit containment spray in their dose analysis need to confirm that no core damage has occurred by confirming safety injection has actuated properly. This can be done by verifying safety injection (SI) actuated and SI flow has remained within the values bounded by the delivery curves.

5. Having met the above criteria, stop one containment spray pump.

6. Confirm one spray pump is adequate by verifying containment pressure and temperature are not increasing.

Seabrook Station Evaluation

Step number 3, above, cannot be accomplished at Seabrook Station. This step states that, prior to stopping a containment spray pump, adequate heat removal should exist to allow the operator time to start the idle spray pump if the running pump fails. This is accomplished by verification that two or more containment fan coolers are operating. As discussed below, Seabrook Station design does not allow for operation of containment fan coolers, concurrent with containment spray system operation.

The Westinghouse reference plant has a two train system consisting of one set of high and low pressure ECCS pumps, one spray pump and one containment fan cooler (CFC), each train has a dedicated electrical train including an emergency diesel generator. Each train is considered to be a 100% train in that all design and licensing criteria can be met with only one train in operation. Further, the specification for the spray and CFC systems is such that any combination of sprays and CFCs can accomplish all required safety functions.

Unlike the Westinghouse reference plant, Seabrook Station does not rely on CFC operation for any post accident condition. Though not relied upon, the non-safety related CFC system is available for smaller LOCAs that do not result in a containment spray actuation system (containment pressure less than 18 psig). The design basis of the CFC units is only up to the heat removal conditions of these smaller LOCAs. During such events, containment spray pumps are not actuated, thereby precluding any benefit to stop a pump.

In the event that containment pressure reaches 18 psig, both containment spray pumps are automatically actuated, the component cooling water to the CFC units and other containment loads are automatically isolated. The component cooling system cannot be restored to these units unless cooling to safety related loads were reduced or isolated. This is due to the design basis flow rate of one PCCW pump. It is feasible to realign component cooling water valves to a secured containment spray train and restore it to the original lineup if the remaining containment spray pump failed and was later restored. However, a number of new operator actions would be required to manipulate valves and may not be quick enough to realize any benefit. Furthermore, the non-safety related coolers are not designed for the heat loads of LOCAs of the magnitude to require containment spray actuation.

Per the WOG evaluation, securing one containment spray pump has the potential to introduce a complete interruption of spray flow. This is a new event that assumes one spray pump has been turned off and later the active spray pump is lost. The CFC effectiveness defines how much time is available to restart the secured spray pump if the operating spray pump fails. As mentioned above, the Seabrook Station CFC design does not have sufficient heat removal capability for a large LOCA event. Therefore, even if operators could successfully manipulate valves to realign cooling water, the Seabrook Station CFCs may not be adequate to maintain containment pressure and temperature control. Failure of the operating containment spray pump, then, does introduce a potential to challenge the containment pressure and temperature safety functions. Unlike for the Westinghouse reference plant, the CFCs would not be in operation with a condition requiring containment spray pump automatic start. Furthermore, based on the design basis heat load of the CFCs and the requirement to realign component cooling water, adequate time is not ensured to start the idle spray pump if there is a loss of the operating spray pump.

Per the WOG evaluation, this COA will have virtually no effect on delaying containment recirculation during large break LOCAs. However, the WOG concludes that benefits would be achieved, particularly for small breaks (small LOCA, stuck open power operated relief valve (PORV), steam generator tube rupture (SGTR), main steam line break (MSLB) inside containment), by increasing the time for manual actions at recirculation actuation signal (RAS). As discussed in response to Request 1, for these events, cooldown of the RCS may be achieved such that switchover to the sumps is required. Furthermore, if containment pressure is less than 4 psig, both containment spray pumps are stopped in step 7 of procedure E-1, "Loss of Reactor or Secondary Coolant." Per the WOG evaluation, with larger break sizes the time to RAS is already short; thus, time for manual actions is short, with an insignificant increase due to securing one train of containment spray.

Based on the Westinghouse reference plant, the WOG concluded that, while some risk benefit may be gained for small break (or equivalent) accidents, because containment spray is a non-risk significant system the overall assessment is that this COA is risk neutral. Therefore, based on the Seabrook Station design differences discussed above, there would be a negative effect on plant risk if this COA were implemented. In general, implementation of this step is recommended by the WOG for plants with containment fan coolers capable of removing significant heat loads. This is not the case for Seabrook Station.

The conclusion of the above evaluation is that COA 1A – "Westinghouse Plants Operator Action to Secure One Spray Pump" is not beneficial for Seabrook Station in mitigation of potential sump clogging be Seabrook Station. Therefore, this COA will not be implemented.

A1a - Ice Addendum – Candidate Operator Action 1A –Westinghouse Ice Condenser Plants Operator Action to Secure One Spray Pump

This COA is applicable to Westinghouse ice condenser plants only.

Seabrook Station Evaluation

Seabrook Station is a Westinghouse large dry containment plant. Therefore, this COA is not applicable to Seabrook Station.

A1b-Candidate Operator Action 1B – Operator Action to Secure Both Spray Pumps

The following describes the steps that would be necessary to accomplish this action.

1. It should be verified that at least one containment spray pump is operating.

2. Prior to stopping any containment spray pump, it should be confirmed that the operating spray pumps have completed their safety function by confirming the following:

    a. Containment pressure is less than [Containment Design Pressure] and NOT increasing.

    b. Containment temperature is less than [EQ requirement] °F and NOT increasing.

3. Verify [two] containment fan coolers per train are operating.

4. Plants that credit containment spray in their dose analysis need to confirm that no core damage has occurred by confirming safety injection has actuated properly. This can be done by verifying safety injection (SI) actuated and SI flow has remained within the values bounded by the delivery curves.

5. Having met the above criteria, stop one containment spray pump.

6. Confirm containment pressure and temperature is not increasing.

7. If a second pump is running and containment pressure and temperature are not increasing, stop the second containment spray pump.

8. Confirm that containment pressure and temperature are not increasing.

Seabrook Station Evaluation

The condition of step number 3, above, would not be met at Seabrook Station. This step verifies that [two] containment fan coolers are operating. As discussed below, Seabrook Station design does not allow for operation of containment fan coolers, concurrent with containment spray system operation.

As discussed in the evaluation of COA A1a-W above, unlike the Westinghouse reference plant, Seabrook Station does not rely on CFC operation for any post accident condition. Though not relied upon, the non-safety related CFC system is available for smaller LOCAs that do not result in a containment spray actuation system (containment pressure less than 18 psig). The design basis of the CFC units is only up to the heat removal conditions of these smaller LOCAs. During such events, containment spray pumps are not actuated, thereby precluding any benefit to stop a pump.

In the event that containment pressure reaches 18 psig, both containment spray pumps are automatically actuated, the component cooling water to the CFC units and other containment loads are automatically isolated. The component cooling system cannot be restored to these units unless cooling to safety related loads were reduced or isolated. This is due to the design basis flow rate of one PCCW pump. It is feasible to realign component cooling water valves to both secured containment spray trains. However, the non-safety related coolers are not designed for the heat loads of LOCAs of the magnitude to require containment spray actuation.

Per the WOG evaluation, securing all the containment spray pumps leaves the CFCs as the only active containment heat removal system. A loss of an electrical bus has the potential to reduce the containment heat removal capability by half. The CFC effectiveness defines how much time is available to restart the idle spray pump. As discussed above, the Seabrook Station CFCs are not safety-related, are not relied upon for containment heat removal, and are not designed for the heat loads of large break LOCAs. Therefore, there would be no effective containment heat removal system for large break LOCAs, regardless of electrical bus availability, with the stopping of both containment spray pumps.

Per the WOG evaluation, this COA will have virtually no effect on delaying containment recirculation during large break LOCAs. However, the WOG concludes that benefits would be achieved, particularly for small breaks (small LOCA, stuck open power operated relief valve (PORV), steam generator tube rupture (SGTR), main steam line break (MSLB) inside containment), by increasing the time for manual actions at recirculation actuation signal (RAS). As discussed in response to Request 1, for these events, cooldown of the RCS may be achieved such that switchover to the sumps is required. Furthermore, if containment pressure is less than 4 psig, both containment spray pumps are stopped in step 7 of procedure E-1, "Loss of Reactor or Secondary Coolant." Per the WOG evaluation, with larger break sizes the time to RAS is already short; thus, time for manual actions is short, with an insignificant increase due to securing both trains of containment spray.

Based on the Westinghouse reference plant, the WOG concluded that, while some risk benefit may be gained for small break (or equivalent) accidents, because containment spray is a non-risk significant system the overall assessment is that this COA is risk neutral. Therefore, based on the Seabrook Station design differences discussed above, there would be a negative effect on plant risk if this COA were implemented.

The WOG concluded that implementation of this step requires effective CFCs and minimal or no requirement for iodine or pH control with spray. Implementation of this step is only recommended for plants with containment fan coolers that can remove 100% of the decay heat load when spray is stopped and spray is not required for iodine removal or pH control. These attributes do not apply to Seabrook Station.

The conclusion of the above evaluation is that COA 1B – "Operator Action to Secure Both Spray Pumps" is not beneficial for Seabrook Station in mitigation of potential sump clogging be Seabrook Station. Therefore, this COA will not be implemented.

<u>A2 – Candidate Operator Action 2 - Manually Establish One Train of Containment Sump Recirculation Prior to Automatic Actuation</u>

The proposed COA involves manual transfer of the suction of one safety injection train to the containment sump prior to automatic actuation. One train of safety injection and containment spray remains lined up to the Refueling Water Storage Tank (RWST). If meeting Net Positive Suction Head (NPSH) requirements necessitates using the full volume of the RWST, an alternative would be to allow normal containment sump recirculation to initiate. Add water to the RWST. Transfer the suction of one injection train back to the RWST when adequate water inventory has been restored to the RWST.

A NPSH calculation is needed to define the amount of water that needs to be transferred to containment to support operating the necessary pumps. When

RWST level is below [example 15%] line up injection pump [1] and containment spray (CS) pump [1] to take suction from the containment sump.

Manually:
- Open train [1] sump suction valve
- Verify proper injection flow
- Close train [1] RWST suction line valve
- Verify proper injection flow
- Stop high pressure safety injection (HPSI) pump [2]
- [Stop CS pump 2]

Close RWST re-circulation valve
Or Automatically:
- Actuate train one for containment recirculation.

<u>Seabrook Station Evaluation</u>

Per the WOG evaluation, in order to implement this step a plant must have existing NPSH margin or be able to demonstrate operating only one train of injection in the recirculation mode will improve NPSH requirements to allow manual transfer to containment sump recirculation while significant inventory remains in the RWST. Operating with one train of injection means steps to stop all spray must be implemented and steps to stop one injection train must be implemented. If meeting NPSH requirements necessitates using the full volume of the RWST, the plant would have to be able to implement RWST refill steps. Due to the relatively short time to initiate recirculation flow during a large break LOCA, establishing early recirculation may only occur during smaller breaks. However, there should be analyses to verify component cooling water will adequately handle all heat loads at the earliest time recirculation could be established.

For Seabrook Station, the full amount of RWST inventory (prior to tank vortexing) is required to ensure that there is adequate NPSH margin. The WOG evaluation also states that the staggered recirculation strategy is proposed to make technical sense only when it follows COA 1 (Securing Spray Pump(s) Before Recirculation) within the interval available, so that comments on COA 1 are also relevant. These COAs have been evaluated (above) and conclude that such actions are not appropriate for implementation at Seabrook Station. Furthermore, the benefit of this step is for smaller break LOCAs. As discussed in the previous evaluations, the plant is likely to reach plant cooldown conditions that would preclude the need to switchover to the containment recirculation sump for such LOCAs.

The conclusion of the above evaluation is that COA 2 – "Manually Establish One Train of Containment Sump Recirculation Prior to Automatic Actuation" is not beneficial for Seabrook Station in mitigation of potential sump clogging be Seabrook Station. Therefore, this COA will not be implemented.

A3-CE – Candidate Operator Action 3 – Combustion Engineering Plants Terminate One Train of HPSI/High-Head Injection after Recirculation Alignment

This COA is applicable to Combustion Engineering Plants only.

Seabrook Station Evaluation

Seabrook Station is a Westinghouse plant. Therefore, this COA is not applicable to Seabrook Station.

A3-W – Candidate Operator Action 3 – Westinghouse Plants
Terminate One Train of Safety Injection after Recirculation Alignment

Currently the ERGs have one standard set of SI termination criteria that may not be satisfied post-recirculation depending on the size of the break. The SI termination criteria is:

- Reactor coolant system (RCS) subcooling equal to or greater than the minimum required
- Pressurizer level greater than the minimum level for verification of inventory control
- At least one steam generator available for RCS heat removal and steam generator level being maintained or restored
- RCS pressure stable or increasing

During large break loss-of-coolant accident (LOCA), all of the above conditions may not be met after the initiation of recirculation. Yet, depending on containment sump blockage risk, it may still be advantageous to stop/throttle SI pumps to lower containment sump blockage risk. If plants only require one train of SI pumps to meet licensing requirements, securing all but one SI train after switchover to recirculation still provides adequate core cooling consistent with the licensing bases.

Seabrook Station Evaluation

Per the WOG evaluation, securing one train of SI pumps reduces the total flow through the sump screens and thereby reduces the rate of debris transport to the screen surface and reduces the risk of blockage. The amount and size of debris collected at the containment sump screens is a function of screen size, the flow volume through the screens and the overall inflow to the containment sump. Greater volumetric flow is more likely to "sweep" debris to the containment sump screens and thereby increase the risk of blockage. The flow contribution of one train of SI pumps is approximately equivalent to a containment spray pump, and any flow reduction should reduce the risk of blockage.

For Seabrook Station, however, there are two totally independent containment recirculation sumps. This includes totally independent and separate screens. Each sump supplies an independent train of ECCS with RHR pump taking suction directly from the sump and an independent train of containment spray. With this configuration, the termination of ECCS flow in one train results in a higher volumetric flow rate for the operating train. Since the RHR system is cross-connected and there are common headers servicing the other pumps, the idle ECCS pump side piping experiences less branch flow rates, resulting in higher flow rates through remaining operating pumps. This results in less NPSH available of the remaining pumps, especially significant for the operating RHR pump. Although some areas of the containment floor would experience lower velocities because of overall lower total ECCS flow rates, the localized flow rates in the vicinity of the sump screen would be higher. Therefore, for Seabrook Station, this COA would not reduce (and may increase) the risk of blockage and associated NPSH or screen structural integrity concerns.

Per the WOG evaluation, current plant licensing bases show adequate core cooling with the loss of one SI train (due to single failure) and one SI train remaining operable through out the event. Generally, the loss of one SI train is due to failure of one diesel generator. However, since deliberate manual securing of one SI train is not considered a "failure," the plant may be required to show acceptable consequences with a failure of the remaining running train after manually stopping one SI train. This would mean an interruption of SI flow until the operator could start the standby SI pumps. Since current licensing analysis does not account for interruption in SI flow during single failure, reanalysis and a licensing amendment may be required. For Seabrook Station, based on the above-discussed lack of benefit, such reanalysis and licensing amendment for this compensatory measure would not be justified.

The conclusion of the above evaluation is that COA 3 – "Westinghouse Plants Terminate One Train of Safety Injection after Recirculation Alignment" is not beneficial for Seabrook Station in mitigation of potential sump clogging be Seabrook Station. Therefore, this COA will not be implemented.

A4 – Candidate Operator Action 4 - Early Termination of One LPSI/RHR Pump Prior to Recirculation Alignment

This COA applies to Combustion Engineering (CE) designed plants only. In the CE design the low pressure and high pressure pumps are independent, and thus a low pressure pump can be shut down while the high pressure pump in that train continues to operate. In the Westinghouse designed plants, however, the low pressure pumps provide suction for the high pressure pumps. Therefore, if a low pressure pump is shut down, the entire train of safety injection would be lost because the associated high pressure pump would have to be shut down also.

Seabrook Station Evaluation

Seabrook Station is a Westinghouse plant. Therefore, this COA is not applicable to Seabrook Station.

A5 – Candidate Operator Action 5 - Refill of Refueling Water Storage Tank

This COA addresses potential EOP changes to preemptively prepare to refill the RWST or lineup an alternate makeup source, bypassing the RWST in anticipation of possible sump blockage following the initiation of recirculation. Specific options are:

1. Make preparations and line up to refill the RWST.

2. Make preparations and line up to inject to the reactor coolant system (RCS) or containment sump from an alternate source (bypassing RWST).

3. Initiate RWST refill after initiating sump recirculation/recirculation actuation signal (RAS).

4. Initiate RWST refill before completely transferring the design volume to the containment sump.

Seabrook Station Evaluation

Per the WOG evaluation, the available sources for refilling the RWST, priority and associated line up are plant specific. The possible sources of borated water include:

- Normal make up water via plant specific chemical addition system
- Reprocessed reactor coolant via plant specific liquid waste processing and recovery system
- Spent Fuel Pool
- Adjacent unit RWST
- Other available sources

For Seabrook Station, the make up water source selected to be proceduralized to refill the RWST is the normal blended makeup via the chemical and volume control system. This method is readily available, and is built into the design, such that preparations are minimal and tasks are easily accomplished.

Considering the option for initiating RWST refill after the design RWST volume is completely transferred to the containment sump, the WOG evaluation determined that there would not be an impact on the design requirement for the volume of borated water to be transferred to the containment sump prior to recirculation actuation/RAS. ECCS pump NPSH requirements and containment sump chemistry requirements are thus assured. Other advantages if this approach are that it:

- would not add additional operator burden prior to recirculation/RAS, and
- would not increase the probability of a boron dilution event associated with refill before the initial volume is transferred to the containment sump, which may increase rather than reduce overall risk.

The disadvantages of this approach, as determined by the WOG evaluation, include:

- RWST may not be refilled by the time it is needed should sump blockage occur soon after initiating recirculation.
- Regardless of the time RWST refill is initiated, the injection of greater than one RWST volume into containment may exceed the containment flood plane, with the potential for submergence of equipment and instrumentation inside containment that may be required for the recovery.
- Some dilution of the long-term recirculation sump water supply can occur if the boron concentration of the RWST makeup water is less than the original RWST boron concentration.
- There is an issue in the event of leakage by the RWST outlet valve seats after switchover to recirculation. If these valves leak by, the RWST inventory may be discharged to the RCS as level is raised during the refill. This would improperly raise sump level before it was needed or wanted. This may warrant implementation of a compensatory strategy such as maintaining a slightly higher containment pressure to prevent leakage and/or repair the RWST outlet valves prior to implementing this COA. The generic recommendation to initiate RWST refill after switchover assumes that the RWST is effectively isolated during the refill process.

Considering the option for initiating RWST refill before the design RWST volume is completely transferred to the containment sump, the WOG evaluation determined that this would extend the time to recirculation switchover. The disadvantages of this approach, as determined by the WOG evaluation, include:

- starting refill prior to switchover may interfere with more important operator actions.
- difficulty in assuring complete mixing in the RWST if a different concentration of borated water is used

- Regardless of the time RWST refill is initiated, the injection of greater than one RWST inventory into containment may exceed containment flooding limit, with the potential for submergence of equipment and instrumentation inside containment that may be required for the recovery.
- Some dilution of the long-term recirculation sump water supply can occur if the boron concentration of the RWST makeup water is less than the original RWST boron concentration.
- There is an issue in the event of leakage by the RWST outlet valve seats after switchover to recirculation. If these valves leak by, the RWST inventory may be discharged to the RCS as level is raised during the refill. This would improperly raise sump level before it was needed or wanted. This may warrant implementation of a compensatory strategy such as maintaining a slightly higher containment pressure to prevent leakage and/or repair the RWST outlet valves prior to implementing this COA. The generic recommendation to initiate RWST refill after switchover assumes that the RWST is effectively isolated during the refill process.

The WOG evaluation determined that, if containment flooding to the RCS loop level is not done, then RWST refill is only a temporary measure and not a successful end state. RWST refill or alternate refill bypassing the RWST will provide an alternate success path for large and medium LOCAs only if SAMG guidance is provided to permit filling containment above the elevation of the RCS loops. With the loops covered to at least the mid-plane and normal RHR initiated, and then any make-up to the RCS can be via reverse break flow. Once adequate level is established in the RCS, normal RHR can be used for decay heat removal. Based on this success path, the WOG evaluation stated that this COA is expected to provide a significant positive risk impact.

While the benefits of this action decline with time, prerequisites for action may be time-consuming and require coordinated support. Given this conflict, the level and type of this support should be assessed, and preparations should ensure that additional staff will be available when needed. The technical implications of using different sources vary widely. Use of an adjacent unit RWST, for example, increases risk for the adjacent (presumably shutdown) unit.

Per the WOG evaluation, certain strategies may increase the probability of a Boron dilution event, which may increase rather than reduce overall risk. Complex or ad hoc realignments during accident conditions may be error prone, particularly as stress and burden increase. The impact of each possible failure path should be evaluated. Implementation of ERG/EPG changes to initiate early action to line up to refill the RWST or bypass it to support using an alternate makeup source, if needed, are generally recommended. Actual refill is not generally recommended until after switchover has occurred.

For Seabrook Station, RWST makeup is initiated in step 4 of ECA-1.1, using the chemical and volume control system (CVCS) blended makeup. As discussed in response to Request 1, above, this action is commenced following Step 2 and 3 of ECA-1.1, which aligns the centrifugal charging pumps from the recirculation sump back to the RWST. This realignment effectively provides an additional source of borated water from the unused capacity remaining in the RWST. The ECCS pump switchover level from the RWST to the containment recirculation sumps is based on potential vortexing in the RWST with operation of all of the ECCS pumps through the spray additive tank mixing chamber. The charging pumps take suction from the RWST through separate lines, allowing them to be used for injection of additional unused RWST capacity. This lineup effectively provides an additional source of water in the RWST (approximately 30,000 to 70,000 gallons, depending on the time it takes the operators to complete the RWST switchover). The additional time provided by the 30,000 to 70,000 gallons, the relative ease of lineup to the normal blended makeup, and the WOG-identified disadvantages of aligning the RWST prior to sump clogging indications, provide justification for not initiating RWST makeup prior to or immediately following the normal ECCS switchover from the RWST to the sump.

Also, as discussed in response to Request 1 above, if the RWST reaches a level where the charging pumps can no longer take suction from the RWST, step 49 of ECA-1.1aligns the volume control tank (VCT) for makeup via the CVCS blended makeup system and for supply to the charging pumps to the RCS.

The conclusion of the above evaluation is that COA 5 – "Refill of Refueling Water Storage Tank" had been considered at Seabrook Station and has been, in effect, implemented. It is noted that, although the WOG recommended that RWST makeup be commenced prior to a loss of emergency recirculation condition, the alternative procedure, as described above, meets the intent of the availability of additional volume via the realignment of the charging pump(s) back to the RWST.

A6 – Candidate Operator Action 6 - Inject More Than One RWST Volume from a Refilled RWST or by Bypassing the RWST

This COA evaluates possible operator actions to re-initiate RCS injection, i.e., restore inventory control, if screen blockage causes loss of sump recirculation capability. Proposed actions provide water for re-injection from a refilled refueling water storage tank (RWST) or from an alternate source, bypassing the RWST.

Note that COA 5 evaluated the preparations for and initiation of RWST refill, and the preparations for line up to inject to the RCS or containment sump from an alternate source (bypassing RWST).

Seabrook Station Evaluation

Per the WOG evaluation, the inventory (level) required to support operation of the Emergency Core Cooling System (ECCS) pumps on recirculation will be available in the recirculation sump when RWST level reaches the "low" level value (RAS setpoint). This amount of RWST inventory has been analyzed as sufficient to provide adequate net positive suction head (NPSH) for the ECCS pumps, to provide adequate shutdown margin via sump boron concentration, and support Long Term Cooling via Cold and Hot Leg Injection. The transfer of greater than one RWST volume to containment is outside the design bases of the plant, and may exceed the containment flooding limit with the potential for submergence of equipment and instrumentation inside containment that may be required for the recovery. Thus, the use of an alternate injection source beyond the RWST is considered a last resort means to cool the core.

Per the WOG evaluation, in the event that sump recirculation capability has been lost and core cooling is still maintained, ECA-1.1 provides the appropriate actions to restore RCS inventory control through RWST refill or alternate RCS injection. These actions are intended to maintain core cooling by injection into the RCS until recirculation capability is restored. Since the RWST may not be refilled and available in the early stages of a sump blockage event, bypassing the RWST using an existing plant specific source may be the preferred success path. Success of the RWST refill method depends on preserving the availability of the safety injection or charging pumps by securing them prior to damage following screen blockage and subsequent loss of suction. For Seabrook Station, the charging pumps are realigned to the RWST by step 4 of ECA-1.1. Due to the availability of 30,000 to 70,000 additional gallons in this configuration, the need to commence refill the RWST is less time-urgent. As discussed in response to Request 1, the charging pump flow is throttled as necessary to match the core decay heat load.

The conclusion of the WOG evaluation is that each plant must consider the advantages and disadvantages as they apply to their plant specific design and incorporate this action if it is determined to be risk beneficial with respect to containment sump blockage.

The conclusion of the above evaluation is that COA 6 – "Inject More Than One RWST Volume From a Refilled RWST or by Bypassing the RWST" had been considered at Seabrook Station and has been implemented.

A7 – Candidate Operator Action 7 - Provide More Aggressive Cooldown and Depressurization Following A Small Break LOCA

This COA applies to Combustion Engineering (CE) designed plants only. The Westinghouse Emergency Response Guidelines (ERGs) already address maximizing the cooldown rate up to the Technical Specification limit.

Seabrook Station Evaluation

Seabrook Station is a Westinghouse plant. Therefore, this COA is not applicable to Seabrook Station.

A8-CE – Candidate Operator Action 8 – Combustion Engineering Plants - Provide Guidance on Symptoms and Identification of Containment Sump Blockage

This COA is applicable to Combustion Engineering Plants only.

Seabrook Station Evaluation

Seabrook Station is a Westinghouse plant. Therefore, this COA is not applicable to Seabrook Station.

A8-W – Candidate Operator Action 8 – Westinghouse Plants - Provide Guidance on Symptoms and Identification of Containment Sump Blockage

The purpose of this COA is to add procedural guidance on recognition of sump clogging to the ERGs.

Specific ERG changes associated with this action are:

- Add a continuous-action procedure step to ES-1.3, TRANSFER TO COLD LEG RECIRCULATION, immediately after verifying or establishing recirculation flow instructing operators to check for indications of sump screen clogging with instructions to transition to the appropriate guideline (modified ECA-.1, LOSS OF EMERGENCY COOLANT RECIRCULATION, proposed new ECA-1.3, RECIRCULATION SUMP BLOCKAGE), or proposed new SUMP BLOCKAGE CONTROL ROOM GUIDELINE (SBCRG) if blockage occurs. This continuous-action step would continue to apply for any subsequent guideline entered.

- Add to ECA-1.1, LOSS OF EMERGENCY COOLANT RECIRCULATION, guidance that, if loss of emergency coolant recirculation is due to sump blockage, then the sump blockage guideline applies.

- Add continuous-action steps to guidelines intended for response to sump blockage (modified ECA-1.1, proposed new ECA-1.3, or proposed new

SBCRG) instructing operators to monitor for changes in sump blockage indications and adjusting actions as required.

Seabrook Station Evaluation

Per the WOG evaluation, in most cases, the instrumentation readily available to monitor sump blockage is limited to sump level, discharge pressure, flow and motor current. These parameters indicate pump operating conditions rather than sump blockage itself. If individual plants have direct indication of sump blockage, such as differential pressure across the sump screen or pump suction pressure, these parameters should be included in the guidance.

Seabrook Station is not equipped with an indicator of sump screen differential pressure. Control room indication of pump suction pressure is available for the CBS pump only. As discussed in Section 1 of Attachment 3 to L-2003-201, "NRC Bulletin 2003-01,Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized Water Reactors," because the location of the containment building level detector is outside of the sump screens, this parameter provides only an indirect indication of screen blockage. If the containment building level indication is as expected and ECCS and CBS pump parameters indicate pump distress, this could be indicative of screen blockage. Since operator response would be the same regardless of diagnosis, it is not deemed necessary to proceduralize containment building level indication as a parameter to be monitored.

The conclusion of the WOG evaluation is that, in general, the proposed change is advantageous to most plants. However, each plant must consider the advantages and disadvantages as they apply to their plant specific design and incorporate this action if it is determined to be risk beneficial with respect to containment sump blockage.

The conclusion of the above evaluation is that COA 8 – "Westinghouse Plants - Provide Guidance on Symptoms and Identification of Containment Sump Blockage" had been considered at Seabrook Station and has been implemented. The parameters monitored by the operators are identified in Section 1 of Attachment 3 to L-2003-201, "NRC Bulletin 2003-01,Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized Water Reactors." The WOG-recommended EOP changes have been completed. The operator response parameters that indicate evidence of sump screen blockage is discussed in response to Request 1, above.

A9-CE – Candidate Operator Action 9 – Combustion Engineering Plants - Develop Contingency Actions in Response to: Containment Sump Blockage, Loss of Suction, and Cavitation

This COA is applicable to Combustion Engineering Plants only.

Seabrook Station Evaluation

Seabrook Station is a Westinghouse plant. Therefore, this COA is not applicable to Seabrook Station.

A9-W – Candidate Operator Action 9 – Westinghouse Plants - Develop Contingency Actions in Response to: Containment Sump Blockage, Loss of Suction, and Cavitation

This COA addresses the following proposals related to responses to sump clogging, loss of suction and cavitation. Note that the last item is in response to possible vortexing induced by partial sump blockage:

1. Stop pumps experiencing loss of suction to prevent permanent pump damage.

2. Reduce recirculation flow to the minimum required to support design basis or critical safety functions.

3. Verify containment cooling unit operation to minimize cooling demand for containment spray flow.

4. Establish alternate water sources to inject into the reactor core and spray into the containment.

5. Optimize use of available sources of flow for injection into the reactor core and spray into the containment.

6. Cool-down and depressurize the reactor coolant system (RCS) using the secondary system to reduce required injection flow to the RCS and allow placing the residual heat removal (RHR) system in service.

7. Backflush the recirculation flow path to remove blocking material from sump screens.

8. Vent pumps that have become air-bound.

<u>Seabrook Station Evaluation</u>

Per the WOG evaluation, one fundamental issue involves the appropriate placement of contingency responses to sump blockage. Possibilities include the development of a new guideline (proposed ECA-1.3, RECIRCULATION SUMP BLOCKAGE), including the guidance as a modification of existing procedures (in particular, ECA-1.1, LOSS OF EMERGENCY COOLANT RECIRCULATION) or providing guidance in the form of a SUMP BLOCKAGE CONTROL ROOM GUIDELINE (SBCRG). This SBCRG would be similar in format and usage to the existing SEVERE ACCIDENT CONTROL ROOM GUIDELINES.

Seabrook Station has incorporated the response to sump screen blockage into the existing procedure ECA-1.1. It is noted that the majority of the WOG development group favored guidance outside the ERG system, since this enables implementation of interim guidance with minimum long-term changes to the ERG system. However, the WOG recognized individual facilities should retain the option of placing this guidance within their Emergency Operating Procedures. They stated, in particular, that facilities that have already implemented changes to their procedures should not be penalized for their proactive approach to this issue. This is the case for Seabrook Station

Per the WOG evaluation, the majority of the contingency actions are consistent with current procedure tasks (ECA-1.1 for Westinghouse, Monroeville plants). Explicit procedures for contingency actions in the event of sump blockage will increase the probability of establishing alternate RCS makeup sources and using the available sources wisely. Any additional procedure steps may decrease the time available for the operator to perform other tasks. In conclusion, guidance for contingency actions will be beneficial to risk in terms of priorities of actions and available alternatives.

Per the WOG evaluation, each plant must consider the advantages and disadvantages as they apply to their plant specific design and incorporate any or all of these actions if it is determined to be risk beneficial with respect to containment sump blockage.

In general, the following contingency actions in response to sump blockage were determined by the WOG to be advantageous:

a. Stop Pumps Experiencing Loss of Suction to Prevent Permanent Pump Damage

b. Reduce Recirculation Flow to the Minimum Required to Support Design basis or Critical Safety Functions

c. Verify Containment Cooling Unit Operation to Minimize Cooling Demand for Containment Spray Flow

d. Establish Alternate Water Sources to Inject Into the Reactor Core and Spray Into the Containment

e. Optimize Use of Available Sources of Flow for Injection Into the Reactor Core and Spray Into the Containment

f. Cool-down and Depressurize the RCS Using the Secondary System to Reduce Required Injection Flow to the RCS and Allow Placing the RHR System in Service

The WOG recommended that Item g (Backflush the Recirculation Flow Path to Remove Blocking Material From Sump Screens) not be implemented and no further work be performed. Based on information in NUREG/CR-6808, backflushing the sump has significant negative impacts that may outweigh any potential benefits. Note that Seabrook Station does not have the design capability for backflushing the sump screens (see response to Request 3).

The WOG also judged that Item h (Vent Pumps That Have Become Air-Bound) is advantageous to most plants, but not appropriate for inclusion in the ERGs.

For Seabrook Station, with the exception of item c (Verify Containment Cooling Unit Operation to Minimize Cooling Demand for Containment Spray Flow), the above WOG-recommended items (a through f) have been incorporated into procedure ECA-1.1, "Loss of Emergency Coolant Recirculation." As discussed under the evaluation of COA 1A, unlike the Westinghouse reference plant, the containment fan coolers are not safety related and are not relied upon for containment cooling following a LOCA. In the event of a large break LOCA (of the magnitude that requires containment spray actuation) they are automatically shutdown, and are not designed for the associated heat loads of such an accident. Therefore, this step is not applicable to Seabrook Station.

The conclusion of the above evaluation is that COA 9 – "Westinghouse Plants - Develop Contingency Actions in Response to: Containment Sump Blockage, Loss of Suction, and Cavitation" had been considered at Seabrook Station and has been implemented. With the exception of item c, which is not applicable to the Seabrook Station design as described above, the WOG-recommended items have been incorporated into procedure ECA-1.1. A scenario-based description of the operator responses in this regard is included in response to Request 1.

A10 – Candidate Operator Action 10 - Early Termination of One Train of HPSI/High-Head Injection Prior to Recirculation Alignment (RAS)

This COA addresses an Emergency Procedure Guidelines (EPG) strategy change for early termination of high pressure safety injection (HPSI) prior to containment sump recirculation alignment. This COA applies to the Combustion Engineering-designed plants only.

Seabrook Station Evaluation

Seabrook Station is a Westinghouse plant. Therefore, this COA is not applicable to Seabrook Station.

A11 – Candidate Operator Action 11 - Prevent or Delay Containment Spray for Small Break LOCAs (<1.0 Inch Diameter) in Ice Condenser Plants

This COA is applicable to Westinghouse ice condenser plants only.

Seabrook Station Evaluation

Seabrook Station is a Westinghouse large dry containment plant. Therefore, this COA is not applicable to Seabrook Station.

Request 3. NRC Bulletin 2003-01 provides possible interim compensatory measures licensees could consider to reduce risks associated with sump clogging. In addition to those compensatory measures listed in Bulletin 2003-01, licensees may also consider implementing unique or plant-specific compensatory measures, as applicable. Discuss any possible unique or plant-specific compensatory measures that were considered for implementation at Seabrook. Include a basis for rejecting any of these additional measures considered.

Response 3. The following is a description of unique or plant-specific interim compensatory measures that were considered for implementation at Seabrook Station and the basis for rejection of each:

Administrative controls to maintain maximum level in the RWST in order to delay the switchover to containment sump recirculation

This measure was found not to provide a significant delay in the time to switchover. Referring to Figure 6.3-10 of the UFSAR, there is only approximately 7 inches of level between the bottom of the overflow line and the Technical Specification approach alarm. The tank level is currently maintained above this alarm. Therefore, 7 inches is the maximum increase in level that additional administrative controls could provide. For the highest ECCS and CBS pump flows with both trains operating, this would only add 30 seconds more to the 26 minutes available before switchover to the sump is required. Based on this, the benefit of the administrative control was not judged to be significant for this interim compensatory measure.

Identification in ECA-1.1of the spent fuel pool for makeup source for the RWST

Similar to the RWST case, there is little margin between the technical specification required level in the spent fuel pool and the highest achievable level. However, use of this as a makeup source is still feasible, albeit limited. The normal makeup source via the chemical and volume control system (CVCS) would still have to be used for replenishment of the RWST, as well as for makeup of the used water for the spent fuel pool (which is fed from the RWST). In addition, makeup from the spent fuel pool would require local operation of manual valves. Blended makeup from the CVCS can be accomplished from the control room. The use of the limited spent fuel pool volume available can be decided upon during consultation with the Technical Support Center (TSC). Based on the above, it was judged that proceduralizing this action for an interim compensatory measure would not provide a significant benefit.

Identification in ECA-1.1of the other sources (especially unborated) makeup sources for the RWST

There is a potential concern for reactivity events with the use of unborated water. The means to accomplish makeup are time consuming. This would be difficult to proceduralize. The use of the CVCS is much more efficient. Other sources are considered more of a last resort. Therefore, it would be appropriate to obtain the support of consultation with the TSC to establish such potential alternate sources. Based on the above, it is judged that proceduralizing this action for an interim compensatory measure does not provide a significant benefit.

Closing the second RHR discharge to cold leg injection isolation valve, shortly following switchover to the containment recirculation sump

As discussed in response to Request 1, Step 4.c. of ES-1.3, "Transfer to Cold Leg Recirculation," closes one of the RHR discharge to cold legs isolation valves. This step reduces total RHR flow and increases NPSH margin for the ECCS pumps. This is a Seabrook Station-unique step that had been developed in 1986, based on a Westinghouse analysis. That analysis demonstrated that, with a failure of one RHR pump or ECCS train, there was a shortfall in NPSH for the remaining operating RHR pump and the centrifugal charging (high head injection) pump. It is of note that, for Seabrook Station, the operation of one train of ECCS causes pump flows to be higher , due to the open cross-connect in the RHR header and other common ECCS pump headers.

The closing of the other RHR discharge to cold leg isolation valve at the same time was considered as an interim compensatory measure. This would further reduce total ECCS flow, allowing for more NPSH margin. The reduced flow is acceptable because the decay heat removal function of the SI and charging pumps is sufficient at the time of switchover. However, this would require a reanalysis of the plant response to a LOCA to ensure that it is acceptable. Furthermore, the action is not single failure proof. A loss of an electrical train would preclude the operation of the second motor-operated valve. As noted above, this is one of the scenarios for which this action would provide the most benefit. This is still under consideration for the long term, but was judged, for the above reasons, not to provide enough benefit (without further analysis and review), as an interim compensatory measure.

<u>Throttling of Containment Spray flow, shortly after switchover to the containment recirculation sump</u>

The design basis for Seabrook Station is that one train of containment spray (CBS) is adequate for a design basis accident. As addressed in the evaluation of COA 1A, Seabrook Station cannot rely on containment fan coolers as a backup means to assure containment cooling. The stopping of one of two CBS pumps would not meet the WOG-recommended criteria. Seabrook Station had considered the possibility of throttling, using the containment spray isolation valves. Considering a single failure, this action would be taken only if both pumps were operating. The total flow from both pumps could be throttled to achieve the design basis flow for one pump. In this way, if one pump were to fail, the throttled valve associated with the remaining operating pump could be quickly reopened.

This interim compensatory action was not implemented because of limitation of valve manipulations and the lack of flow indication. The spray isolation valves can be throttled, but they can only be throttled open from the closed position. The pump recirculation valves are automatically closed on a containment spray actuation signal. Therefore, the pumps would have to be operated without flow for a period of time. Alternatively, the containment spray signal could be reset and the recirculation valves reopened. However, these recirculation valves can not be throttled and would provide an excessive flow rate, with the concurrent initially open spray isolation valves. There may be ways to concurrently operate the valves, however, system flow indication would be required to ensure desired results are achieved. There is no flow indication. The possibility of estimating flow using indication of CBS pump suction and discharge pressure was considered. The difference in pressures can be used to estimate the change in pump head and compared to the pump curves. However, considering inaccuracies of the readings, calculations, and pump curves, there is not reasonable assurance that the desired results are attainable. Based on the above issues, the benefit of this action was not judged to be significant for this interim compensatory measure.